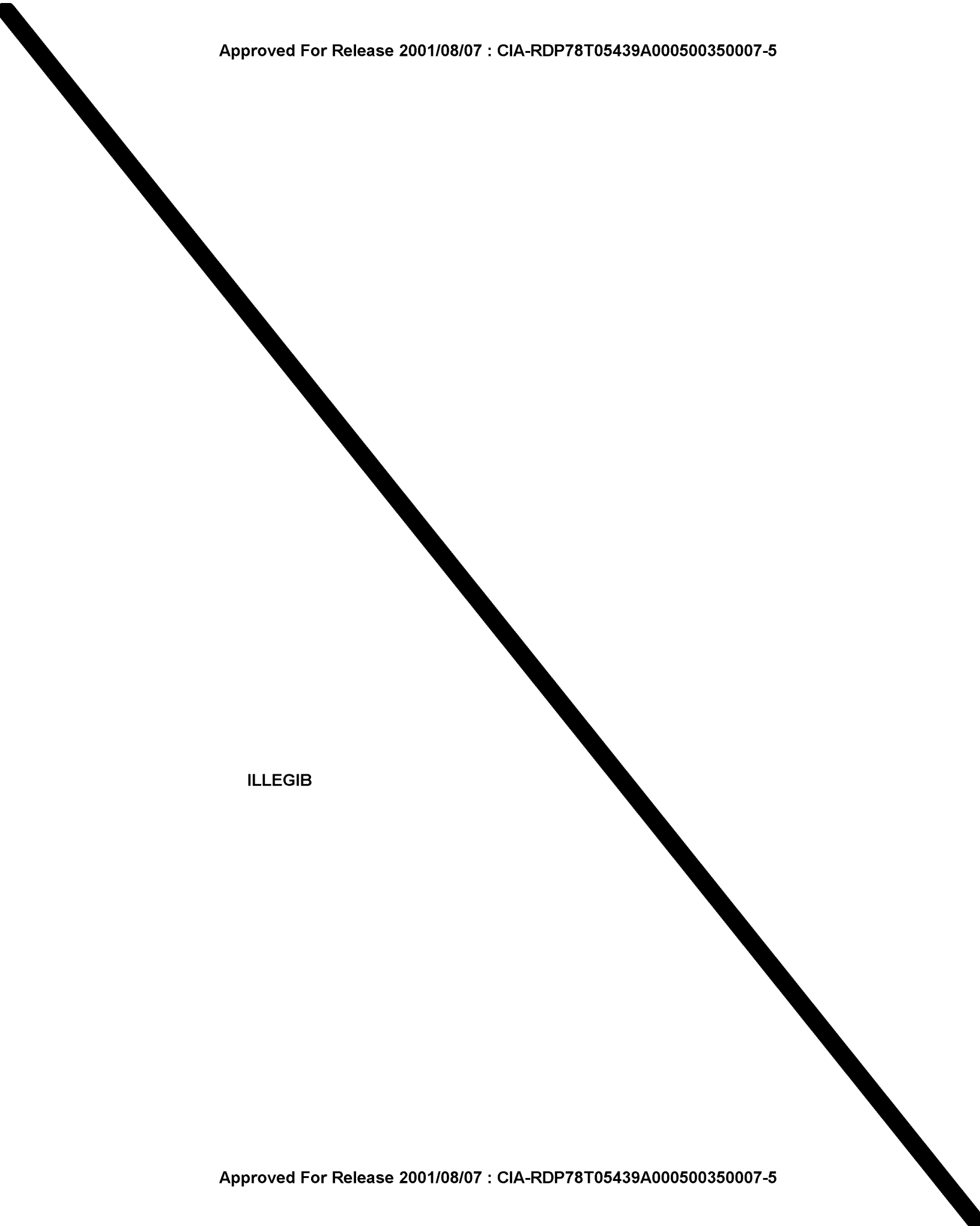

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PHOTOGRAPHIC INTERPRETATION REPORT

URANIUM ORE CONCENTRATION PLANT HENG-YANG, CHINA

NPIC/R-317/65
SEPTEMBER 1965

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SEPTEMBER 1965

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

INTRODUCTION

A uranium ore concentration plant is located 5.5 nautical miles (nm) south of the city of Heng-yang and 78 nm south of Chang-sha in Hu-nan Sheng (Province), China, at 26-47N 112-38E (Figure 1). The principal operational facilities of the plant are secured by a wall which encloses a 31-acre area, and support facilities in the immediate vicinity occupy roughly another 10 acres. The plant is served by a double-track rail spur from the main rail line between Kuang-chou (Canton) and Han-kou. A hard-surfaced road extends from the northeastern corner of the plant to the village of Tung-yang-tu where it intersects the Heng-yang/Lei-yang road. A road also extends from the plant to the Hsiang River.

The plant is at an elevation of 284 feet above sea level and 95 feet above the Hsiang River. No bedrock is visible in the surrounding terrain. Freezes may occur during January and February in exceptionally cold years.

No plants engaged in the reduction of uranium oxide (U_3O_8) to metallic uranium have been identified within a 25-nm radius of the

FIGURE 1. HENG-YANG URANIUM ORE CONCENTRATION PLANT AND AUXILIARY FEATURES, [redacted]

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Heng-yang plant. The destination of the U_3O_8 and the various by-products of the plant is unknown. At the present time, the sources of ores which are shipped to the plant by rail are only partially identified, and no uranium mining has been identified within a 25-nm radius of the plant. Three mining districts of the greater Heng-yang region probably serve as sources of other ores, notably lead and zinc. 1/

In addition to the wall surrounding the main part of the plant, security is enhanced by guard towers and floodlights which are situated at intervals along the top of the wall. All gates are closed and guarded. Some facilities in the plant are separately secured, such as the west end of an ore storage and blending building (item 57, Figure 2) in the west-southwest section of the plant where an interior wall has been erected. Three large conduits crossing the plant area from north to south have been either partially or completely closed since [redacted] The Hsiang River precludes easy access to the north, south, and west sides of the plant.

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[redacted] features have been observed at the plant. Three antiaircraft artillery (AAA) batteries and many personnel trenches have been observed in the area outside the secured portion of the plant (Figure 1). The presence of the AAA batteries is a security measure which has been observed at most Chinese installations connected with the atomic energy program in China. However, walls, guard towers, compartmentalization of facilities and activities inside the plant, and the AAA batteries observed at the Heng-yang installation have not been observed at other Chinese uranium ore concentration plants. Since [redacted], 11 rectangular buildings formerly located just southwest of the plant have been razed, an action which in effect cleared a field of fire. Thus, the plant is obviously an important and sensitive installation connected with processing uranium ores and possibly with the extraction of various rare elements other than uranium.

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DESCRIPTION OF THE PLANT

Descriptions of the facilities in the plant are presented in Tables 1 and 2 (Figures 2-4). Permanent structures in the plant are built of brick and are probably quite durable. Recent additions to the original buildings are constructed of other materials such as sheet iron. Shrubs or trees have been planted in the northeastern portion of the plant. Construction shacks have been razed when no longer needed, and there is ample room for expansion on all sides of the present installation.

Except for the administration and security buildings, the plant was under construction in [redacted] At that time the planned flow of materials and solutions through the plant was easily discernible, but as construction continued this flow became less apparent for a number of reasons. For example, pipelines were buried or re-excavated, some were barely visible because of the small scale of the photography, and the installation of pipelines and equipment was still in progress when the latest photography was obtained.

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Support facilities and areas outside the secured part of the ore concentration plant consist of a construction materials area (item A, Figure 4), a service area (item B), a storage, assembly, and supply area (item C), a construction area (item D), a possible liquid reagent unloading facility (item E), a possible diesel powerplant (item F), a transloading shed (item G), and a water intake control area (item H). A housing area is situated northeast of the plant. The number of apartment buildings in that area has increased. These apartments could accommodate technicians. The number of personnel employed at the plant at this time cannot be determined from photography.

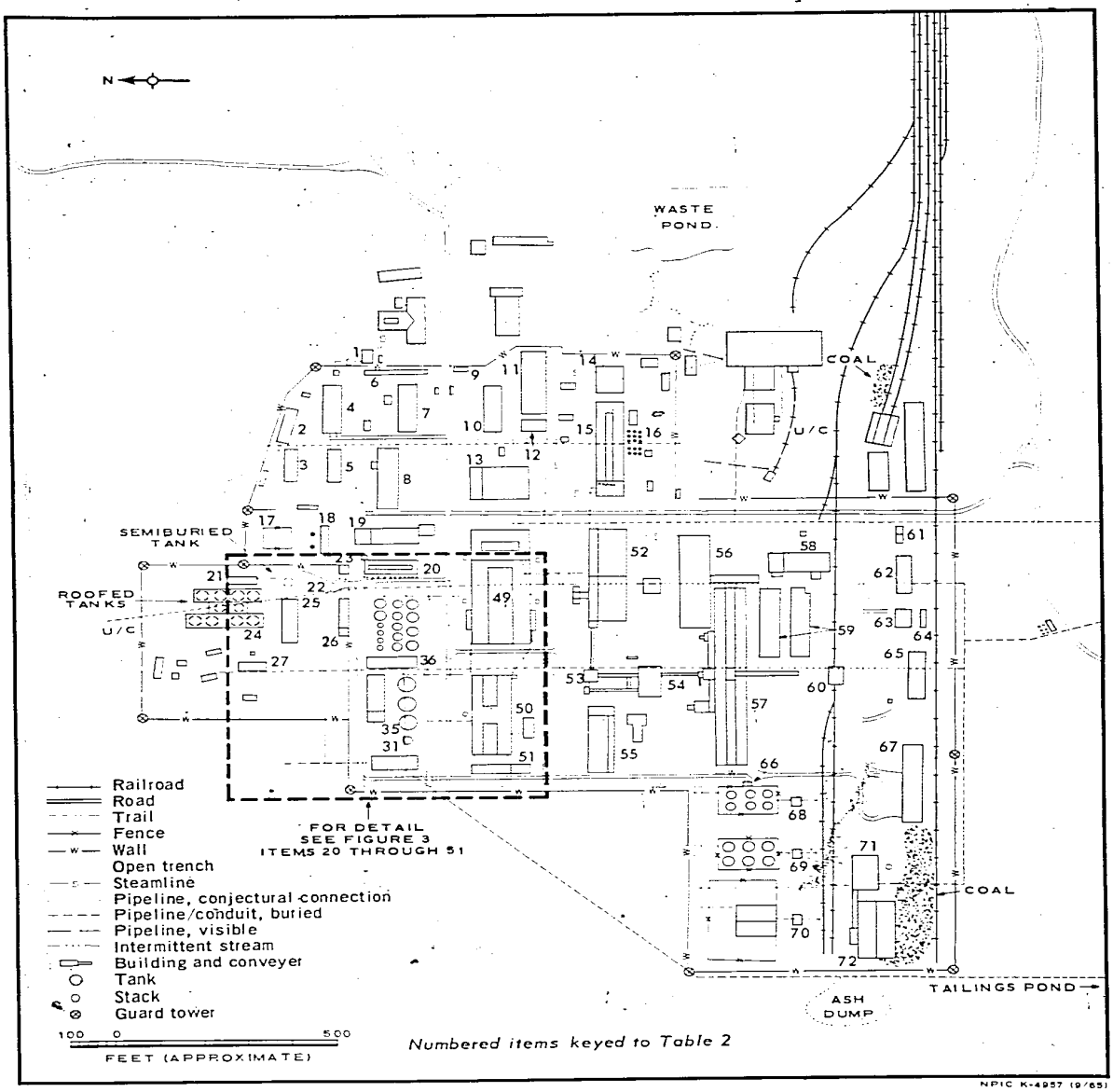

FIGURE 2. LAYOUT OF THE HENG-YANG URANIUM ORE CONCENTRATION PLANT. (Item numbers missing on this drawing are shown on Figure 3.)

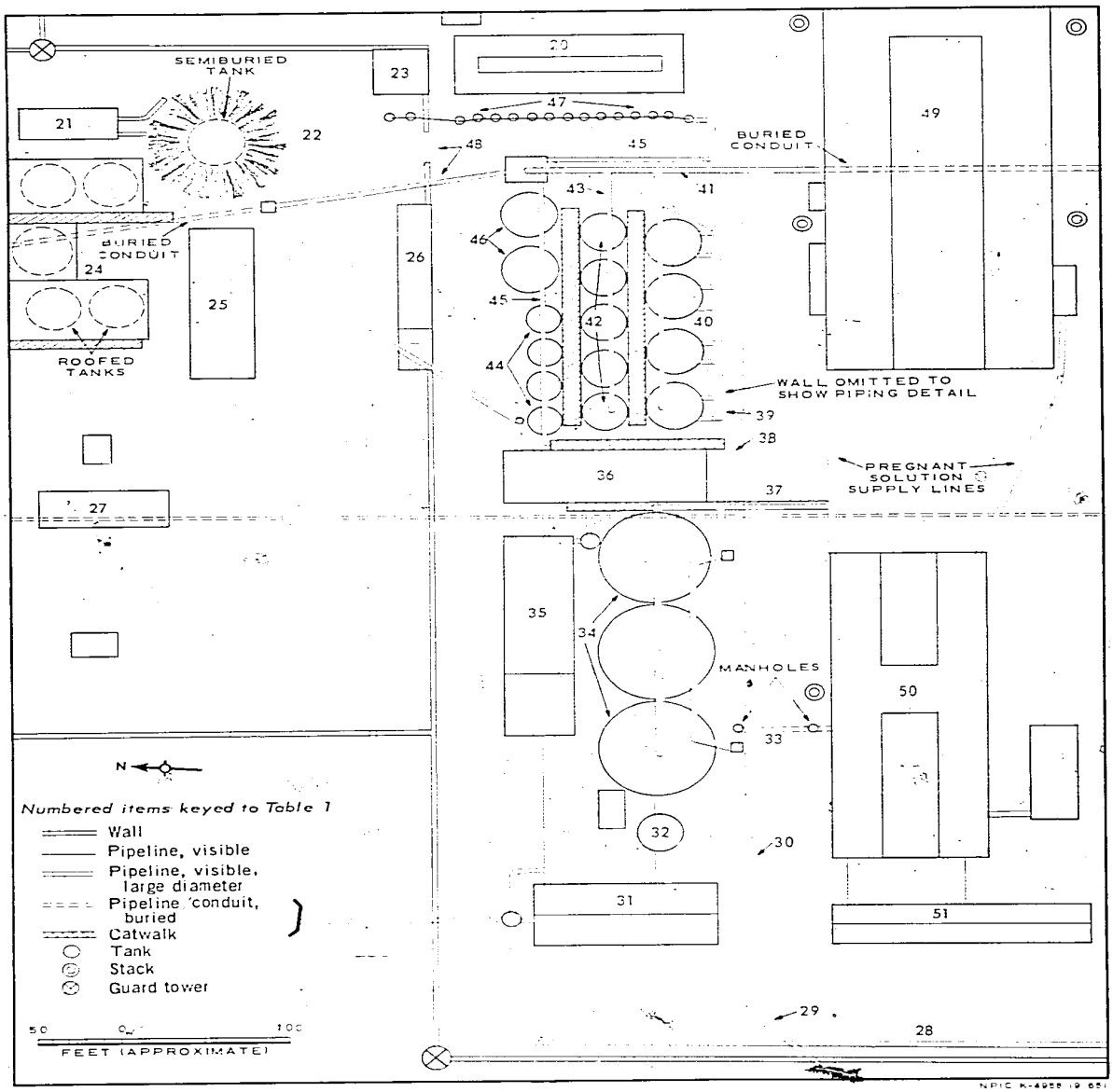

FIGURE 3. DETAIL OF LAYOUT OF THE TANK FARM OF THE HENG-YANG URANIUM ORE CONCENTRATION PLANT.

Table 1. Description and Dimensions of Facilities, Heng-yang Uranium Ore Concentration Plant (Item numbers appear in Figures 2 and 3)

Item	Description
1	Steamplant
2	Service building, vehicle repair
3	Preparation building for technical supplies
4	Vehicle storage repair building
5	Preparation building for technical supplies
6	Guard force ready building and office
7	Administration building, possibly for supplies and services
8	Testing fitting-out building for technical supplies
9	Gatehouse
10	Administration building, possibly for plant operations
11	Barracks or guardhouse; possible messhall kitchen in center section
12	Service building for barracks guardhouse (item 11)
13	Possible service building for acid ore leaching and mixing building (item 49)
14	Service building for probable U_3O_8 recovery building (item 15); under construction
15	Probable U_3O_8 recovery building for treating carbonate ores; under construction
16	Tanks (15) and valve house; under construction
17	Switchyard (electrical); fenced
18	Control building for switchyard (item 17); 2 tanks or transformers on north side
19	Shop; possible electrical transformer and switching facility in south end of building
20	Solvent recovery building and shop with ion exchange columns (12) and auxiliary tanks (2) on west side
21	Service building, probably for servicing semiburied tank (item 22)
22	Semiburied tank
23	Shop; possible ion exchange columns (2) on west side
24	Roofed tanks (possibly 10) for possible by-product recovery; under construction
25	Probable roofed tank building; storage for organic solvents; under construction
26	Construction shop
27	Construction shop; connected to ore storage and blending building (item 57) by buried pipeline
28	Liquid reagent pipeline
29	Buried pipeline for tailings pond recycle water
30	Buried pipeline; tank farm bypass for tailings pond recycle water
31	Valve house and pumping station for liquid reagents
32	Reagent tank
33	Possible buried pipeline; recycle for barren solution
34	Tanks (3); recycle water for tailings pond and spent solutions from resin-in-pulp building (item 50)
35	Possible valve house and organic reagent building
36	Possible valve house and blending building for tailings pond water and raffinate; pipe trestles topped by catwalks along east and west sides
37	Pipe bridge for lagged and possibly bare pipes; return of spent solution from east side of resin-in-pulp building (item 50) to tanks (item 34)
38	Buried pipeline bypassing tanks (items 40 and 42)
39	Low pipeline to tanks
40	Tanks (4); for second-stage tailings water reagent concentration
41	Pipe bridge to acid ore mixing and leaching building (item 49)
42	Tanks (5); for third-stage tailings water reagent concentration
43	Pipeline over third-stage water reagent concentration tanks; connected to pipeline that goes to acid ore mixing and leaching building (item 49)
44	Tanks (4); for organic solvent
45	Pipeline; for organic solvent-pregnant solution collection
46	Tanks (2); for organic solvent separation
47	Ion exchange columns (12) and auxiliary tanks (2)

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Table 1. (Continued)

Item	Description	L
48	Overhead pipeline for raffinate: probably under construction	
49	Acid ore leaching and mixing building	
50	Resin-in-pulp building: connected to acid ore leaching and mixing building (item 49) and to tanks (item 34) by 2 supply lines	
51	Valve house and pumping station for liquid reagents	
52	Grinding hall: high bay [redacted]; T-shaped extension on north side of hall	
53	Secondary (fine) ore crusher building: contains temporary ore storage space	
54	Primary (coarse) ore crusher building: contains temporary ore storage space	
55	Shop or laboratory: part of building could be used for product storage	
56	Ore storage building: under construction	
57	Ore storage and blending building: irregularly shaped	
58	Carbonate ore preparation building: 2 small extensions on west side: under construction	
59	Warehouses (2): dimensions of each	
60	Railway car unloading shed	
61	Shipment receiving and gate control building	
62	Administration building: control of incoming ores and supplies	
63	Warehouse: road served	
64	Warehouse	
65	Warehouse	
66	Weighhouse and inspection of incoming ores: probably contains weighing and grading facilities	
67	Warehouse: road served: hardstand on north side	
68	Tanks (6) for liquid reagents: probably contain acids: fenced	
69	Tanks (6) for liquid reagents: probably contain acids: fenced	
70	Tanks (4): roofed: probably contain volatile organic fluids: fenced	
71	Steamplant with adjacent stack	
72	Coal preparation building	

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FLOW OF MATERIALS THROUGH THE PLANT

Although entire departments of the plant have not been completed, enough structures have been erected to indicate the direction, cross relations, and nature of the flow of materials through the main part of the plant. The incomplete construction and lack of sufficient photographic evidence of operation do not permit the formulation, with complete confidence at this time, of flow charts for the carbonate ore mill circuit or for by-products recovery from the carbonate and siliceous ore mill circuits; however, a generalized flow chart has been prepared on the basis of available evidence and is presented as Figure 5.

This chart shows the possible flow of ore, recycled tailings pond water, and reagents through the plant.

ESTIMATED CAPACITY OF THE PLANT

[redacted] when the plant began operations, an estimated 50,000 tons of tailings were discharged from the grinding hall (item 52, Figure 2) into Area E. It is not possible, however, to estimate the percentage of the plant's capacity that was being utilized during that period. The volume of tailings piped to the tailings pond during [redacted] can only be an approximate estimate. A total of 271,000 short tons of tailings had accumulated in the pond by [redacted] an additional 55,000 short tons had accumulated from [redacted] and another 100,000 short tons had accumulated between [redacted] In summary, the total ore tonnage treated as of the end of [redacted] is estimated at 475,000 short tons. This total possibly includes most of the uranif-

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erous ores mined in China up to that time, and it is in excess of the estimated total output of the uranium mines thus far identified.

During the period [redacted] a total of 55,000 short tons of tailings were processed at a rate of about 1,200 tons daily, a process which utilized 60 percent of the plant's estimated capacity. Between [redacted], an estimated 100,000 short tons were treated at a rate of about 675 short tons daily, thus utilizing about 35 percent of the plant's estimated capacity. Therefore, the plant has never been more than partially operational. An accumulation of uraniferous ores in the warehouses over a long period of time may have permitted the comparatively high production rate of 1,220 tons per day which prevailed during, and presumably prior to, [redacted] If the plant's capacity is to be fully utilized when all equipment is installed, it appears that the Chinese will have to increase both mine production and the volume of ore transportation.

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An American designer of uranium plants has estimated that the capacity of the Heng-yang plant will be about 2,000 short tons of ore per day, if and when the plant becomes fully operational.* His estimate is based upon the size of the plant structures and their support facilities and upon the number of rail cars observed in the plant's railyard. The estimated capacity of 2,000 short tons per day is comparatively large, there being only 2 plants in

25X1A

[redacted]

HISTORY OF THE PLANT

The Heng-yang Uranium Ore Concentration Plant was probably in the early stages of construction when it was observed on [redacted] photography, but the quality of that photography was poor. Despite the slackening of the "great leap forward" in the 1960s, the construction of the plant continued, probably because high priority was given to the acquisition of construction materials for this particular project; however, the assembly, installation, and operation of equipment--particularly of specialized chemical machinery--has been slow, hit-or-miss, and subject to changes.

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Crushing and grinding of siliceous ore began early in [redacted] Tailings discharged from a grinding hall (item 52) were piped to

Table 2. Descriptions of Support Facilities and Areas, Heng-yang Uranium Ore Concentration Plant (Lettered items appear in Figure 4)

Facility or Area	Description
A	Construction materials area; processes river sand and gravel; probably in support of ore plant construction
B	Service area; principal structures are: 1) T-shaped probable public relations building (overall dimensions [redacted]; 2) T-shaped possible hospital, messhall, or laundry (overall dimensions [redacted] 50'h); 3) steamplant (see item 1, Table 1)
C	Storage, assembly, and supply area; equipment and engineering supplies
D	Construction area; new buildings under construction are possibly for recovery of by-products from carbonate ores; area contains: 1) possible storage building (80' x 70' x [redacted]; 2) pipeline service and valve house (25' x 20'); 3) possible storage building (75' x 65' x [redacted]; 4) possible storage and reagent preparation building (205' x 90' x [redacted]); 5) valve house and effluent building (60' x 20' x 10'h); waste pond for carbonate ore circuit east of area
E	Possible liquid reagent unloading facility (35' x 15' x [redacted]); pipeline under construction on north side of facility; location of this facility was originally a dump area
F	Possible diesel powerplant ([redacted] consisting of generator hall [redacted] and 3 possible transformer sites; rail served; coal pile (reserve fuel) on north side of rail spur
G	Transloading shed (260' x [redacted]; open storage east of shed
H	Water intake control area, under construction; makeup water basins on north side of area

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*This information was obtained from a consultant's meeting held under NPIC project 11221-65

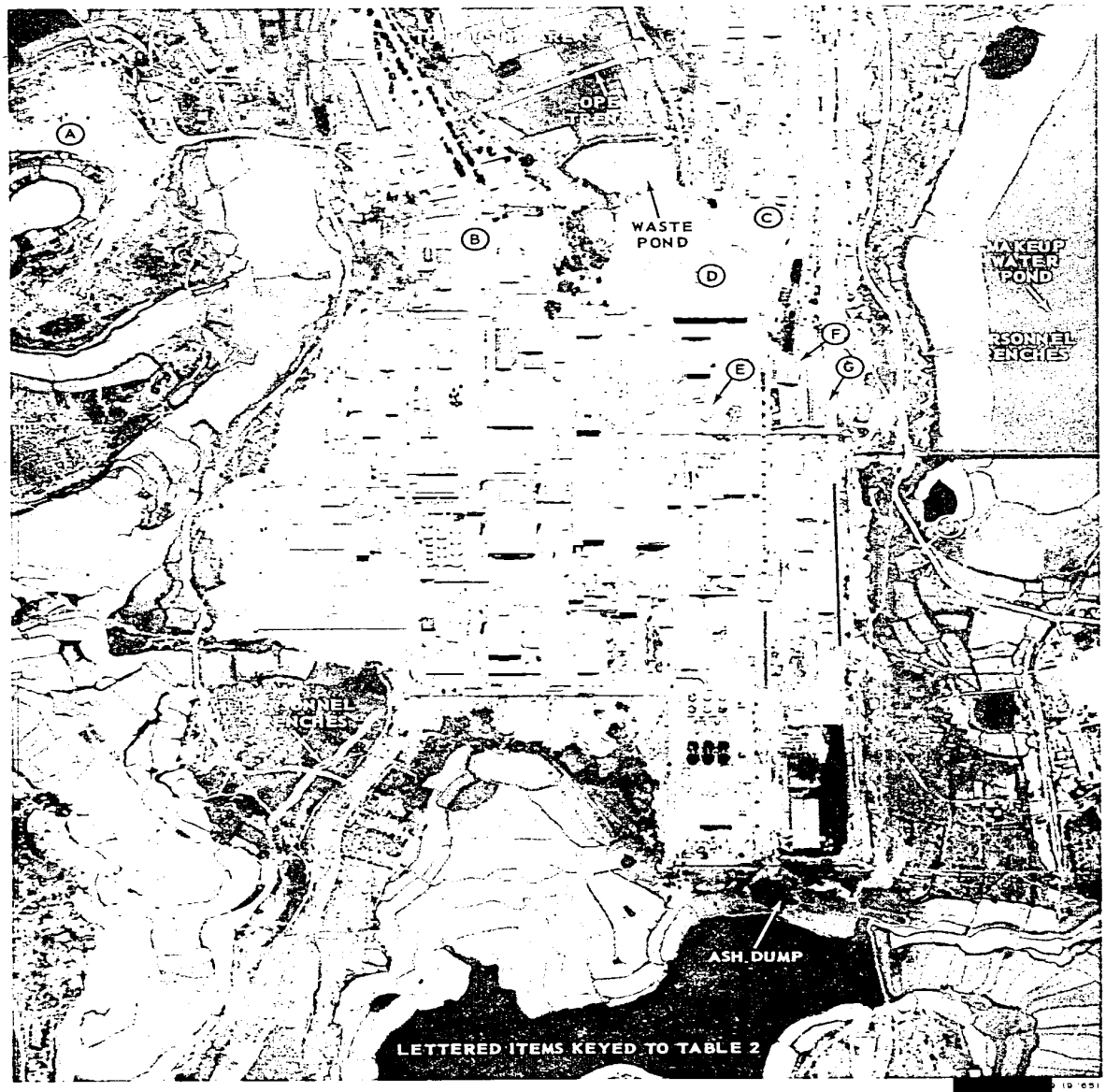

FIGURE 4. SUPPORT FACILITIES AND AREAS, HENG-YANG URANIUM ORE CONCENTRATION PLANT, [redacted]

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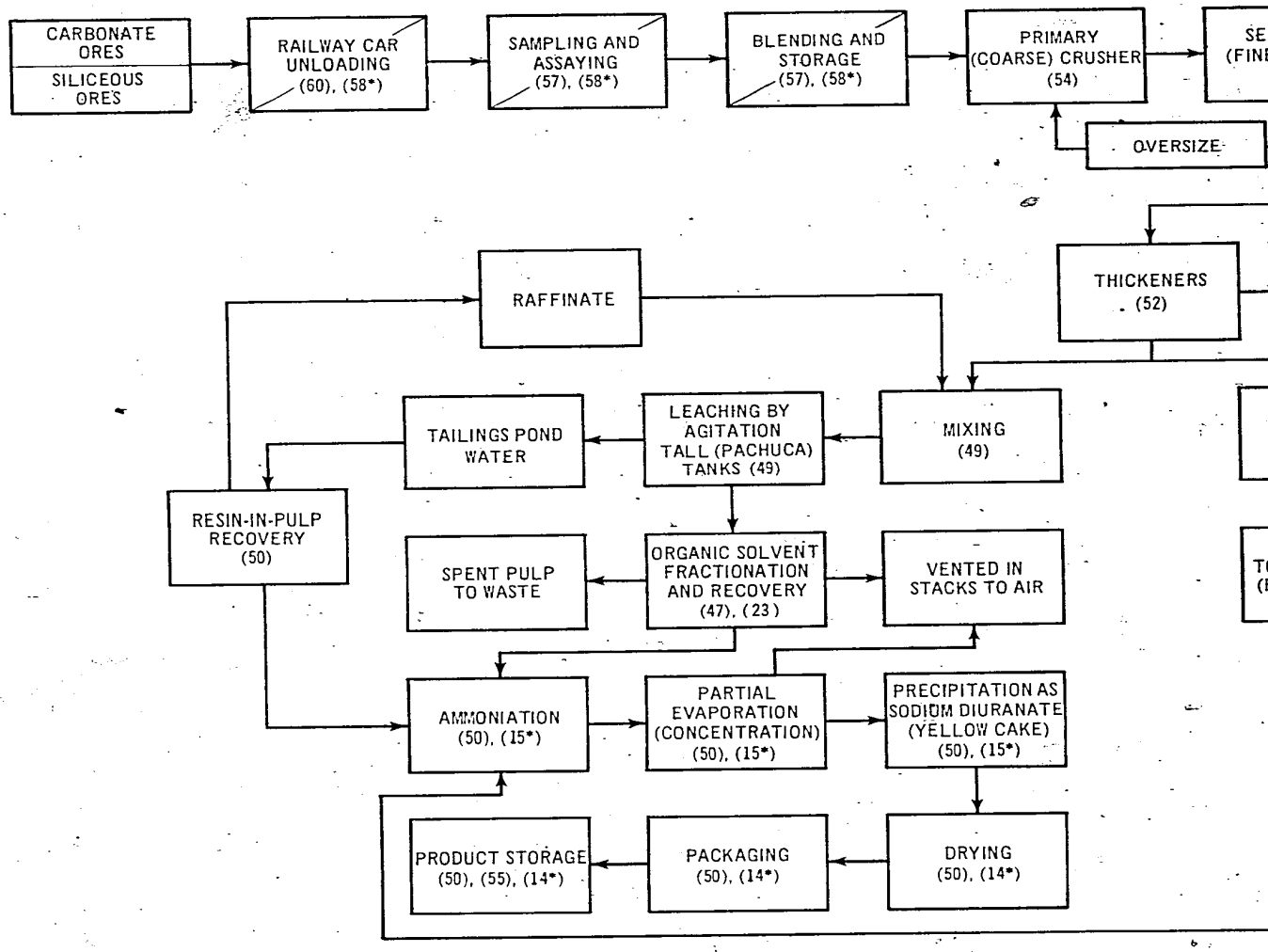
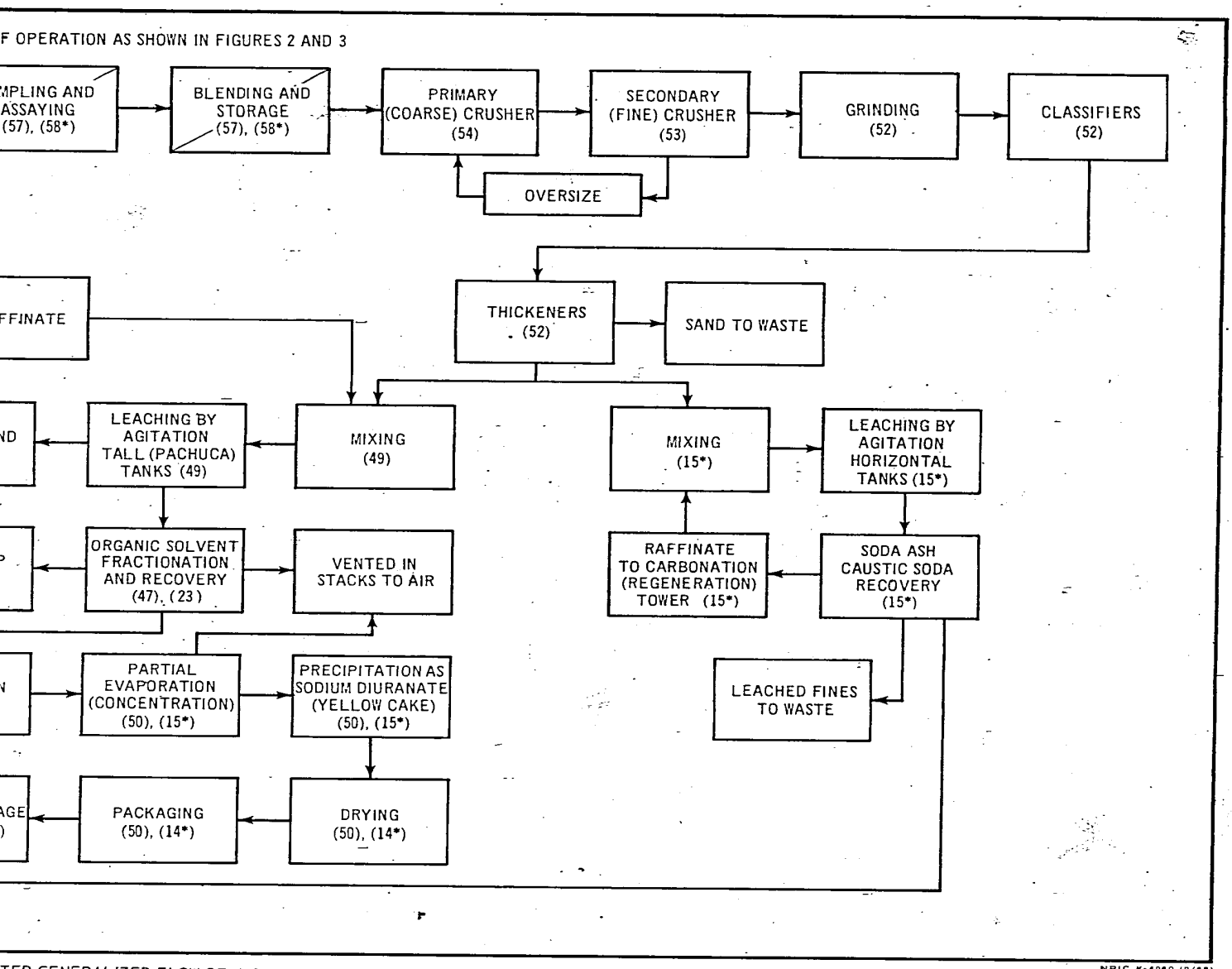
NOTE: NUMBERS IN PARENTHESES INDICATE LOCATION OF OPERATION AS SHOWN IN FIGURES 2 AND 3 •



*UNDER CONSTRUCTION

FIGURE 5. SUGGESTED GENERALIZED FLOW OF MATERIALS THROUGH THE HENG-YANG URANIUM



TED GENERALIZED FLOW OF MATERIALS THROUGH THE HENG-YANG URANIUM ORE CONCENTRATION PLANT.

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25X1D a possible dump area southeast of the grinding hall. An estimated 50,000 tons of mill tailings may have accumulated near the facility during that year. By [redacted] warehouses and administration, guard force, ore supply, and preliminary processing buildings had been erected. One barracks in the eastern part of the plant had been dismantled. A tailings pond had been formed by 2 dams, one about 1,200 feet south of the plant and the other 7,700 feet 25X1D south of the plant. The pond was filled with water in [redacted] it 25X1D probably held about 10,000 cubic feet of tailings.

Between [redacted] 1 of 2 rail-served transloading sheds immediately outside the southeast corner of the plant was being converted to a powerplant (Area F, Figure 4), and construction of this plant probably 25X1D continued into early [redacted] During the same period, construction on a steamplant (item 71, Figure 2) was under way in the southwest corner of the plant, and a coal pile was visible 25X1D by [redacted] Process water could have been released during this period through open drains. Liquid waste, which is higher in radioactive content, could have been allowed to decay in a semiburied tank (item 22). The extraction of 25X1D uranium oxide may have begun early in [redacted] on a pilot-plant scale, using the resin-in-pulp 25X1D process.

During [redacted] construction began on the probable carbonate ore uranium oxide recovery building (item 15). When this building is completed, the plant will eventually be able to 25X1D concentrate all kinds of uranium-bearing ores. 25X1D By [redacted] the tailings that had accumulated during [redacted] in Area E were being pushed eastward toward a waste pond to permit the construction of 2 new buildings. Construction was started in a 3.5-acre area on the north side of the plant. The outfalls of the open drains were filled by this construction, and some process water was chemically treated and returned to extraction facilities by pipelines.

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Construction on the plant continued through [redacted] Although the estimated capacity of the plant had been increased, it had not been fully attained by that date. Facilities for solvent extraction have been observed, but the lack of continuity of pipelines is a probable indication that these facilities were only partially operational by [redacted] Construction probably was continuing on the powerplant (Area 25X1D F). The steamplant (item 71) was put into operation early in [redacted] when steamlines were being installed in various parts of the plant. 25X1D Judging from the increase in the size of the ash dump near the steamplant, it had operated at only a fraction of its capacity during [redacted] 25X1D [redacted] an estimated 425,000 short tons of mill tailings had been discharged into the waste pond south of the plant. Construction continued on the probable carbonate uraniferous ore processing buildings (items 15 and 58). North of the powerplant (Area F), construction of a possible transfer from an overhead to an underground feeder power cable system was in progress. 25X1D

The Heng-yang uranium ore concentration plant is by far the largest uranium mill thus far identified in China. When completed, it should rank as one of the largest mills in the world with dual processing lines. The presence and arrangement of equipment at the Heng-yang plant indicates that the Chinese are knowledgeable about all phases of modern uranium ore concentration processes. The Chinese have experienced delays, as indicated by equipment seen on the ground in the engineering area, in obtaining or fabricating complicated processing equipment. At the Heng-yang plant delays in the final phases of the uranium oxide recovery processes reflect delays in the manufacture and procurement of chemical equipment.

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REQUIREMENT

CIA. C-SI5-82,315

NPIC PROJECT

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